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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/998,858	10/31/2001	Wen-Ben Chou	LAM2P295	6935

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EXAMINER	
CHEN, KIN CHAN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 10/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/998,858	CHOU ET AL.	
	Examiner	Art Unit	
	Kin-Chan Chen	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 August 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-16 and 21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-16 and 21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *0803* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3-16 and 21are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al. (US 6,207,544; hereinafter "Nguyen") in view of Chiu et al. (US 6,333,27; hereinafter "Chiu").

Nguyen teaches a method for fabricating a nitride spacer of a gate structure. A first etch process may be performed using a first etchant gas. The first etch process may be discontinued upon removing the portion of the spacer layer, leaving a thin spacer layer. The endpoint detection method may be used to detect a removal of a portion of a spacer layer having a specific thickness. A second etch process may be performed using a second etchant gas. The second etch process may be configured to remove the thin spacer layer. The second etch process may be discontinued when the second etch process has continued for a predetermined period time. The etching may be performed in-situ. The second etch process is configured to remove the thin spacer layer, leaving the spacer for the gate structure (col. 5, lines 10-17, col. 6, lines 28-40).

Nguyen teaches that the endpoint of etching may be determined **using traditional optical spectrometers** (col. 6, lines 10-12). The claimed invention differs from Nguyen by specifying using interferometry for first etch endpoint detection (e.g., claims 1, 6, and 7) and using non-interferometry for second etch endpoint detection. However, they are common methods for endpoint detection in dry etching process. In a method of multi-step plasma etch method, Chiu teaches using first plasma etch method and using first detection apparatus (such as interfermetry) to partially etch a microelectronic layer and employing second plasma etch employing a second detection apparatus (such as plasma / optical emission spectroscopy, so-called non-IEP) in order to accurately determine the endpoint of plasma etching, measure /control the thickness (abstract, col. 2, lines 44-66; col. 12, lines 23-28). Hence, it would have been obvious to one with ordinary skilled in the art to use said two-step etching and endpoint detection of Chiu in the process of Nguyen because Chiu teaches that to do so would accurately determine the endpoint of plasma etching, measure /control the thickness. Furthermore, it would have been obvious to one with ordinary skilled in the art to use commonly used endpoint detection methods in the plasma etching process when required, see Maydan et al. (US 4,618,262) and Gardner et al. (US 5,912,188) as evidences in the record for the commonly used interferometry and non-interferometry (non IEP) methods for etching endpoint detection. As to dependent claims 3 and 9, with the interferometry method, It would have been obvious to one with ordinary skilled in the art to determine the thickness of an etch depth during the etch operation implementing the distance between consecutive maximum intensities.

The limitations of dependent claims 4, 5, 8, 10, and 11 have been addressed above and rejected for the same reasons, supra.

Dependant claims 12, 13, and 14 differ from the prior art by specifying various thickness of the spacer. Because same are merely a matter of choices of design depending on the product requirements, it would be obvious to one skilled in the art to use various dimensions for fabricating a semiconductor device in order to accommodate the specific product design and meet the product requirement.

Dependent claims 15 and 16 disclose commonly used etchants for etching nitride in the art of semiconductor device fabrication. Hence, It would have been obvious to one with ordinary skilled in the art to use same etchants to same in order to provide their art recognized advantages and thus produce an expected result.

3. Claims 1, 3-16 and 21are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. (US 6,277,700; hereinafter "Yu") in view of Chiu et al. (US 6,333,27; hereinafter "Chiu").

Yu teaches a method for fabricating a nitride spacer of a gate structure. A first etch process may be performed using a first etchant gas. The first etch process may be discontinued upon removing the portion of the spacer layer, leaving a thin spacer layer. The endpoint detection method may be used to detect a removal of a portion of a spacer layer having a specific thickness. A second etch process may be performed using a second etchant gas. The second etch process may be configured to remove the thin spacer layer. The second etch process may be discontinued when the second etch

process has continued for a predetermined period time. The etching may be performed in-situ. The second etch process is configured to remove the thin spacer layer, leaving the spacer for the gate structure (col.1, lines 64 through col. 2, lines 60).

Yu teaches that the endpoint of etching may be determined with endpoint detection (col. 2, lines 58-59). The claimed invention differs from Yu by specifying using interferometry for first etch endpoint detection (e.g., claims 1, 6, and 7) and using non-interferometry for second etch endpoint detection. However, they are common methods for endpoint detection in dry etching process. In a method of multi-step plasma etch method, Chiu teaches using first plasma etch method and using first detection apparatus (such as interfermetry) to partially etch a microelectronic layer and employing second plasma etch employing a second detection apparatus (such as plasma / optical emission spectroscopy, so-called non-IEP) in order to accurately determine the endpoint of plasma etching, measure / control the thickness (abstract, col. 2, lines 44-66; col. 12, lines 23-28). Hence, it would have been obvious to one with ordinary skilled in the art to use said two-step etching and endpoint detection of Chiu in the process of Yu because Chiu teaches that to do so would accurately determine the endpoint of plasma etching, measure / control the thickness. Furthermore, it would have been obvious to one with ordinary skilled in the art to use commonly used endpoint detection methods in the plasma etching process when required, see Maydan et al. (US 4,618,262) and Gardner et al. (US 5,912,188) as evidences in the record for the commonly used interferometry and non-interferometry methods for etching endpoint detection. As to dependent claims 3 and 9, with the interferometry method, It would

have been obvious to one with ordinary skilled in the art to determine the thickness of an etch depth during the etch operation implementing the distance between consecutive maximum intensities.

The limitations of dependent claims 4, 5, 8, 10, and 11 have been addressed above and rejected for the same reasons, supra.

Dependant claims 12, 13, and 14 differ from the prior art by specifying various thickness of the spacer. Because same are merely a matter of choices of design depending on the product requirements, it would be obvious to one skilled in the art to use various dimensions for fabricating a semiconductor device in order to accommodate the specific product design and meet the product requirement.

Dependent claims 15 and 16 disclose commonly used etchants for etching nitride in the art of semiconductor device fabrication. Hence, It would have been obvious to one with ordinary skilled in the art to use same etchants to same in order to provide their art recognized advantages and thus produce an expected result.

Response to Arguments

4. Applicant's arguments filed August 25, 2003 have been fully considered but they are not persuasive.

Applicant has argued that Nguyen fails to disclose or suggest implementing minimum of two etch processes. In fact, Nguyen clearly discloses that one or more etching processes may be used to etch nitride sidewall spacers (col. 5, lines 10-16; col.

6, lines 28-30). Furthermore, as has been stated in the office action, Chiu teaches using first plasma etch method and using first detection apparatus (such as interfermetry) to partially etch a microelectronic layer and employing second plasma etch employing a second detection apparatus (such as plasma / optical emission spectroscopy, so-called non-interferometry)

Applicant has argued that Yu fails to disclose or suggest using endpoint detection method. As stated in the office action, Yu teaches that the endpoint of etching may be determined with endpoint detection (col. 2, lines 58-59). Furthermore, as has been stated in the office action, Chiu teaches using first plasma etch method and using first detection apparatus (such as interfermetry) to partially etch a microelectronic layer and employing second plasma etch employing a second detection apparatus.

One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. In re Merk &Co., Inc., 800F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Maydan et al. (US 4,618,262) teach the commonly used interferometry method for etching endpoint detection. Gardner et al. (US 5,912,188) show that four common methods for determining the endpoint of dry etching process including interferometry and optical emission spectroscopy (col. 2, lines 9-16). Rutzke

(US 6,122,050) teaches that plasma –optical emission spectrometer is a species of plasma spectrometer (col. 1, lines 35-58).

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (703) 305-0222. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (703) 305-2667. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-2934.

September 30, 2003

K. C. Chen

KIN-CHAN CHEN
PRIMARY EXAMINER